## HSL-WI5
RAGSDALE (APM) BODYMAKER
HIGH SPEED CONTROL PACKAGE

The Systems Engineering HSL-WI5 Ragsdale (APM) Bodymaker High Speed Control Package is an electronic upgrade which provides:

◊ **Reduced Tooling Damage:** by accurately detecting short can/tear-offs and immediately de-activating the clutch and cupfeed to prevent feeding additional cups.

◊ **Repeatable Air Strip Control:** to prevent air stripping and blow-out problems and thus reduce the occurrence of short cans or tear-offs.

◊ **Accurate Clutch Control:** Incorporates BDC brake wear compensation algorithm to stop press at BDC regardless of actual brake response.

◊ **High Speed:** Package operates at speeds in excess of 500 Cans Per Minute.
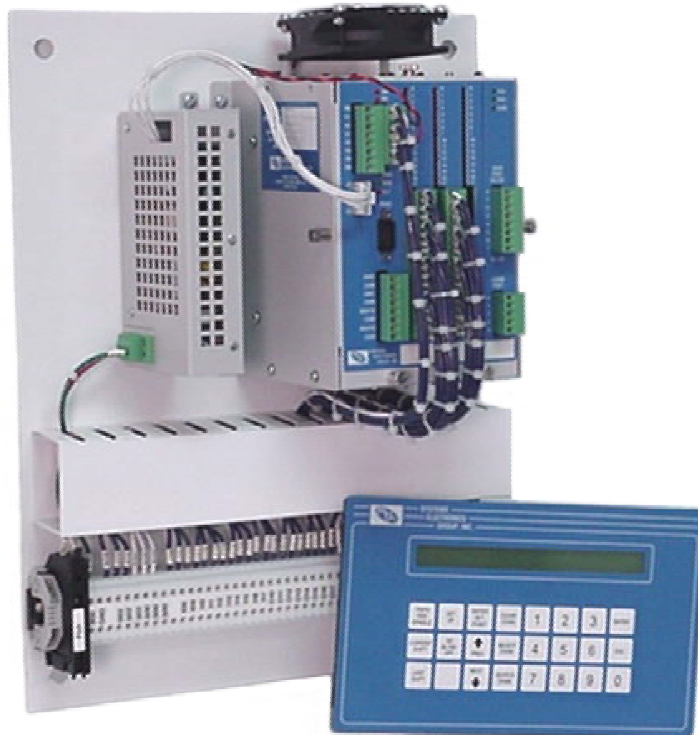
Features

- Performs high speed control functions of Ragsdale (APM) Bodymaker to speeds in excess of 500 Cans Per Minute (machine mechanically permitting). This includes clutch control, cupfeed control, air strip control, as well as die protection (short can detection).

- Performs the following control functions:

  - Rapid response control of clutch/brake system for emergency stops (die protection) as well as precise BDC stops. **Note: The clutch solenoid outputs of the HSL-WI5 are not intended as safety contacts for the bodymaker clutch and must not be the only interrupt to the clutch solenoids.**
  - Accurate short can detection to a resolution of ¼" can length.
  - Highly repeatable air strip control to reduce can stripping and blow-out problems.
  - Reliable, timed cupfeed control to insure proper cup loading and protection from miss-loads.
  - Brake wear compensation (Auto BDC timing programming) algorithm to stop press at BDC regardless of brake response.
  - Brake response determination allows displaying of actual brake response (in degrees).
  - Brake response alarm to indicate when brake stopping response (in degrees) has exceeded user preset limit.
  - Trimmer speed reference (0-10volt analog output) provides reference to trimmer proportional to speed of bodymaker (user scalable).
  - Alarm detection: short can detection, die sensor fail alarm, timing signal fail detection, clutch output failure detection, no ram motion alarm, resolver failure detection, and brake response too long.
  - Data Acquisition: Total number of good cans produced and total number of short can faults (for both current and last shift).

General Description

The HSL-WI5 Ragsdale (APM) Bodymaker high speed logic module is an electronic upgrade for the Ragsdale (APM) Bodymaker which performs the high speed control functions of the bodymaker including: rapid response clutch/brake control, accurate short can detection, reliable cupfeed and precise air strip control. In addition, the package provides a brake wear compensation feature which automatically adjusts the BDC timing signal to stop the press at BDC regardless of brake stopping response.

Alarm detection is provided including: short can detection, die sensor failure detection, timing signal failure, brake response too long and more. Data collection includes: Total good can count and total short can faults count (both for the current shift and last previous (last) shift). In addition, the package also provides a trimmer speed reference output which is proportional to the bodymaker speed.

The package is not a dedicated "black box", but instead is implemented using the high performance Systems M4500 PLC/PLS module which allows easy customization by either SEA or the end user. The M4500 module is programmed using the DOS-based SYSdev programming

package which allows the module to be programmed in any combination of Ladder logic or High-level (subset of "C"), as well as perform on-line monitoring and trouble-shooting. The M4500 incorporates a built-in PLS which interfaces directly with the machine mounted resolver and provides all machine timing, eliminating the need for an external PLS.

Clutch / Brake Control

The clutch/brake solenoids of the Bodymaker are activated by the HSL-WI5 through the electro-mechanical two hand safety control circuitry provided externally by the user. The fast 0.5millisecond throughput of the HSL-WI5 along with the fact that the PLS is fully integrated in the module, allows extremely fast and repeatable de-clutching and braking response to be achieved. Normally the clutch is controlled via inputs to the HSL-WI5 that are mapped from outputs on the host PLC. However, detection of any of the alarms (short can, die sensor failure, etc.) results in an immediate de-clutch of the solenoids.

Air Strip Control

The HSL-WI5 provides a repeatability of 0.5 milliseconds for the air strip control thus reducing can stripping and blow-out problems. Both an "Air Strip (Low)" and "Air Strip (High)" timing signal are provided to activate the air strip when running in the low and high speeds respectively. The air strip is activated a user settable number of strokes prior to feeding the first cup to prevent hydraulic lock when the first can is formed.

Brake Wear Compensation

The HSL-WI5 incorporates a brake wear compensation or automatic BDC timing feature which stops the press at BDC regardless of the actual braking response of the clutch/brake. The stopping compensation is accomplished by automatically adjusting the BDC timing signal based on the previous stop. Any overrun is detected and a new BDC timing signal is computed such that the machine will stop at the desired location on the next stop. Two BDC signals are provided: one for low speed and one for high speed. Both incorporate the brake wear compensation feature. The appropriate BDC timing signal (low or high) is adjusted based on the speed of the machine when the BDC stop was initiated.

In addition to the brake wear compensation, the HSL-WI5 also calculates the actual brake response (in degrees). This is the number of degrees from where the clutch was de-activated (BDC timing location) to where the crankshaft actually ended up stopping. This can then be displayed by the operator or maintenance personnel to determine the condition of the brake.

Short Can Detection

The "Short Can Check" timing signal, along with the existing machine mounted short can sensor, is used to verify the entire length of the can. The short can sensor must see can the entire time the "Short Can Check" timing signal is *"on"*. If the can is short (tear-off) or any void is detected, the *Short Can* alarm is generated. The clutch is immediately de-activated as well as the cupfeed solenoid. The resolution of the short can check is 0.5 milliseconds. At a machine speed of 250CPM, this translates to approximately ¼" resolution in can length.

Alarm Detection

In addition to the *Short Can* alarm, the module detects the following alarms*: Die Sensor Failure, Timing Signal Fail, Clutch Output Failure, No Ram Motion Detected, Resolver Failure*, and *Brake Response Too Long*. The *Die Sensor Fail* alarm occurs if the "short can" sensor fails *"on"*. The *Timing Signal Fail* occurs when any of the timing signals generated in the PLS section fail to

Alarm Detection (cont'd)

change state periodically while the machine is running. The *Clutch Output Fail* alarm occurs if either clutch output fails *"on"* or *"off"*. *No Ram Motion* occurs if no motion is detected after the clutch is activated. The *Resolver Failure* alarm occurs if motion is detected after the clutch is de-activated. The above alarms immediately de-activate the clutch when any one occurs with the respective alarm message displayed on the HSL-WI5. These alarms are summed into one output that indicates to the host PLC that an alarm did occur.

Data Collection

The following data is collected for both the current shift and the previous (last) shift: Total number of good cans produced and total number of short can faults. This data can be viewed locally on the display of the HSL-WI5 by the operator or production control personnel. This information is updated ("current" shift transferred to "last" shift) based on the change of state of a discrete input. This data can also be passed back to a host PLC via the optional S4516 Communications Board. For Modicon PLCs, the MODBUS protocol is used. For TI PLCs the S3000 network is used in conjunction with an S3016-505 mounted in the TI rack. For A-B PLCs, an S4516-DF1 is used which implements the A-B DF1 protocol.

HSL-WI5 Keypad / Display

The keypad / Display of the HSL-WI5 is designed to mount in the door of the enclosure that the HSL-WI5 sub-panel is mounted in (maximum cable length of 8 feet). The keypad contains 24 keys consisting of data display commands, setup commands, and a numeric keypad. The display of the HSL-WI5 is a 2-line by 40-character back-lit LCD display which displays the selected data and setup menus. The keypad / display can be used by the operator or production control personnel to view the collected data and can be used by authorized personnel (passcode or key switch protected) to adjust the timing and all setup parameters.

IMPORTANT SAFETY WARNING

The HSL-WI5 is intended as a high-speed logic gate to provide consistent and accurate clutch control. It is not designed as a redundant, dual-processor clutch brake safety module. The HSL-WI5 must not be the only means of controlling the bodymaker clutch mechanism. Good design practice dictates the use of safety interlocks on any device that starts or stops automatically that can cause personnel injury to operating or maintenance personnel. The HSL-WI5 must be used only in conjunction with industry approved safety interlock contacts, implemented in accordance with ANSI B11.1 safety requirements, otherwise serious personnel injury may result.

Specifications

Power Requirements:
Voltage: 100-240VAC, 50/60HZ
Current: 0.5 Amps @ 115VAC
0.25 Amps @ 230VAC

Temperature Ranges:
Operating: 0 to 55°C
Storage: 0 to 70°C

Resolver Interface:
Resolver Type: Systems Electronics Group
RSV34-MS1 or equivalent (also can be paralleled
with existing resolver/PLS)

Resolver Cable: Systems Electronics Group
RSV-RSCBLE-XX

Control Inputs:
Voltage Range: 10-30VDC
Input "On" Voltage (min):   10.0 volts
Input "On" Voltage (max):   30.0 volts
Input "Off" Voltage (max):   5.0 volts
Input Current (max): 15 milliamps @ Vin=30V
Optical Isolation: 1500 Vrms

Outputs:
Voltage Range: 10-30VDC
Output "On" Voltage (min): VCC-2.00 volts
Output "On" Voltage (max): VCC-0.25 volts
Output "Off" Voltage (max): 1.5 volts
Output "On" Current (max-cont): 0.5 Amps DC
Output "On" Current (100msec): 3.0 Amps DC
Optical Isolation: 1500 Vrms

Ordering Information

The HSL-WI5 package is provided for back-panel mounting inside the user's existing control cabinet. In addition, a NEMA 12 enclosure can be purchased to house the HSL-WI5 if the required space is not available in the existing user's cabinet. The part number for the optional NEMA 12 enclosure is HSL-WI5-ENCL. The order number for the HSL-WI5 is as follows:

Part Number	*Description*
HSL-WI5	Ragsdale (APM) Bodymaker high speed control package consisting of a pre-wired sub-panel (17" X 13" X 8") for mounting in the existing user's control cabinet including the following:

1ea.   M4500 PLC/PLS module (with required I/O boards)
1ea.   D4591 Display / Keypad
1ea.   HSL-WI5 User's Manual
1ea.   HSL-WI5 Keypad Quick Reference Manual
1ea.   HSL-WI5 Program Disk
1ea.   M4500 User's Manual

HSL-WI5 Options (*purchased separately*)

The following items can be purchased separately as required or desired:

Part Number	*Description*
HSL-DSP	Remote RPM/Position Display
HSL-WI5-ENCL	NEMA 12 enclosure for HSL-WI5 (20" X 16" X 10")
RSV34-MS1	Resolver (required if machine is not already equipped with resolver)
RSV-RSCBLE-XX	Resolver Cable
S4516	Communications Option Board (Modicon and TI PLCs)
S4516-DF1	Communications Option Board (A-B PLCs)